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Analysis of Electric Arc Furnace Lining Regeneration Process

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Abstract: *In this article, it is important to choose the inner layer of the furnace when melting steel alloy. Magnesite bricks were used as refractory materials for the lining of the basic furnace. Corroded areas of the furnace lining were restored by spraying previously used firebrick powder and pulverized slag mixture into the hot furnace lining, and the service life of the furnace lining was increased.*

Keywords: *Lining, Electric Arc Furnace, Magnesite, Alloy, Refractory Brick, Slag.*

Introduction

One of the most important tasks in the world today is the development of resource – saving technology by increasing the service life of electric furnace linings, which are used to liquefy ferrous metal and its alloys produced in machine – building, tool – making and production enterprises(Laribi et al., 2019). Scientific and research works on increasing the service life of the furnace lining are carried out on a global scale, including development of the composition of the lining in accordance with the composition of the alloy being liquefied; to study the influence of the composition of liquid slag released from the alloy during the operation of the furnace on the corrosion resistance of the furnace lining; reduction of furnace lining erosion by improving the foaming of slag released from the liquid alloy; It is important to increase the service life of the furnace lining by restoring the damaged parts of the furnace lining during the furnace operation using used refractory materials and crushed slag mixtures(Pranowo et al., 2020).

Result and Discussion

First of all, an electric arc furnace was selected, which is suitable for liquefaction of steel alloy(Lim et al., 2021). The main reason for this was that the steel alloy was acidic, which led to rapid corrosion of the furnace lining. First of all, it is important to choose the

inner layer of the furnace when melting the steel alloy(Chen et al., 2021). Magnesite bricks were used as refractory materials for the lining of the basic furnace. The walls of the furnace were made of magnesite bricks made of refractory materials. In the preparation of magnesite brick, natural magnesite ($MgCO_3$) was heated to a temperature of 1400^0 C in special furnaces [6 – 9]. Magnesite then decomposed into MgO and CO_2(Acevedo-García et al., 2020). After adding a certain amount of clay and lime to the obtained MgO and mixing it with water, it was pressed and heated to a temperature of 1500^0 C, and the expected result was achieved. When restoring the basic furnace lining, first of all, liquid metal was removed from the furnace as shown in Figure 1(Rahimi et al., 2020).

Figure 1. The Process Of Extracting Liquid Metal From A 30 – Ton Electric Arc Furnace

The furnace lining was then observed through the furnace window under the control of the steel melter, caster, and workshop as shown in Figure 1. Due to the acid nature of furnace – based liquefied steel(Genç et al., 2022), we can observe corroded and cracked areas after liquefied once(Daligaux, 2023). The furnace lining was then observed through the furnace window under the control of the steel melter, caster, and workshop as shown in Figure 2(Liu et al., 2022). Due to the acid nature of furnace – based liquefied steel, we can observe corroded and cracked areas after liquefied once (Daligaux, 2023).

Figure 2. The process of restoring lining from the window of an electric arc furnace

If such a situation is observed, the bricks used before the base furnace, magnesite refractory bricks and slag were crushed in a cone – shaped grinder and brought to a powder state as shown in Figure 3(Wang et al., 2019).

Figure 3. A mixture obtained by grinding refractory magnesite brick and slag into powder

Results

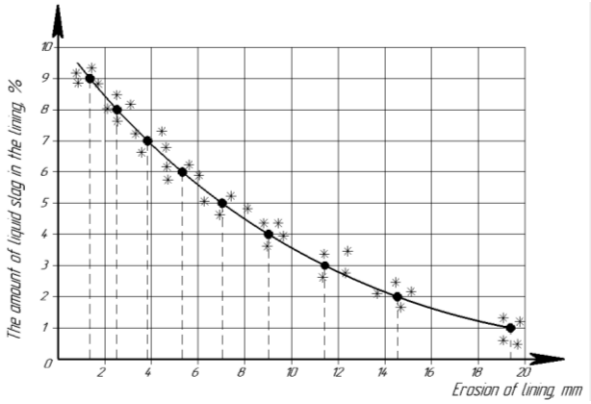

Figure 4. Corrosion of the lining using the amount of liquid slag contained in the lining

As shown in graph 1, liquid slag obtained from basic furnace lining (CaO, SiO_2, MnO, FeO, TiO_2, CaS) from 1% to 10% was added to 90% magnesite powder and mixed and put into the cell (Wang et al., 2019). Add 99% used fireproof material and 1% separated liquid slag to agar, and spray the prepared mixture on the damaged areas of the furnace lining through a special device. In the case of using this refractory mixture, it was observed that 19 mm was destroyed. If 2% liquid slag is used for furnace lining, 15 mm, 3% 11 mm, 5% 7 mm, 6% 4.8 mm, 7% 4 mm, 8% 2.2 mm, 91% fireproof As a result of the experiments, it was found that by sprinkling 9% liquid slag with powder material on the eroded part of the lining, the erosion of the lining was reduced by 1.8 mm(Rey et al., 2022). As shown in graph 3.2, as the percentage of used refractory material and liquid slag decreased, the corrosion of the furnace lining increased. The processes in this graph were replicated at least 5 to 7 times for each study under laboratory conditions(Acevedo-García et al., 2020). Due to the fact that the temperature of the furnace was 1600 – 1700^0 C, the sprayed mixture closed the damaged areas of the lining and the durability of the lining of these furnaces was reached from 600 to 800 hours of steel liquefaction through the above technology(Wang et al., 2019).

Conclusion

In conclusion, it can be said that in order to increase the service life of the lining of the 30 – ton electric arc furnace, the previously used refractory materials were crushed with a grinder, and after the liquid metal was removed from the furnace, it was sprinkled on the damaged areas of the lining of the furnace using a special device. As a result, the service life of the furnace lining was increased.

In order to increase the service life of the lining of the 30 – ton electric arc furnace, based on the weight of the previously used refractory material and the weight of the used refractory material, 10% slag (Cr_2O_3, MgO, Al_2O_3, SiO_2, a little FeO, CaO) was ground together with a grinder, and after the liquid metal was removed from the furnace, the furnace sprinkled with a special device on the damaged areas of the lining. As a result, the service life of the furnace lining was increased.

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